Catalogue of American Amphibians and Reptiles.

NUSSBAUM, RONALD A., AND EDMUND D. BRODIE, JR. 1981. *Taricha granulosa.*

Taricha granulosa (Skilton) Rough-skinned newt

Salamandra granulosa Skilton, 1849:202. Type-locality, "Oregon," probably near Oregon City, Clackamas County, Oregon (Fitch, 1938). Type(s) not known to exist, apparently collected by Reverend George Gary sometime between June, 1844 and July, 1847 (Fitch, 1938).

Triturus similans Twitty, 1935:76. Type-locality "Robinson Creek, Ukiah, [Mendocino County] California." Holotype, Museum of Vertebrate Zoology (University of California, Berkeley) 18149, sex unknown, collected 20 April 1935 by Victor C. Twitty (not examined by authors).

Triturus granulosus: Fitch, 1938:148.

Taricha granulosa: Schmidt, 1953:26.

• CONTENT. Two subspecies are recognized: *granulosa* and *mazamae.*

• DEFINITION. A species of *Taricha* with rough, granular skin in the terrestrial phase; dorsum brown, venter yellow or orange; vent usually without a dark band; iris with at least some light (yellow) pigment; eyes relatively small, not protruding beyond profile of head when viewed from above; upper and lower eyelids uniformly dark (excluded from light ventral coloration); vomerine teeth in two diverging, longitudinal series, usually forming a V-pattern; breeds in ponds, lakes, and slow-moving streams; eggs attached singly to submerged vegetation; larvae normally with two longitudinal rows of light spots on each side of the body.

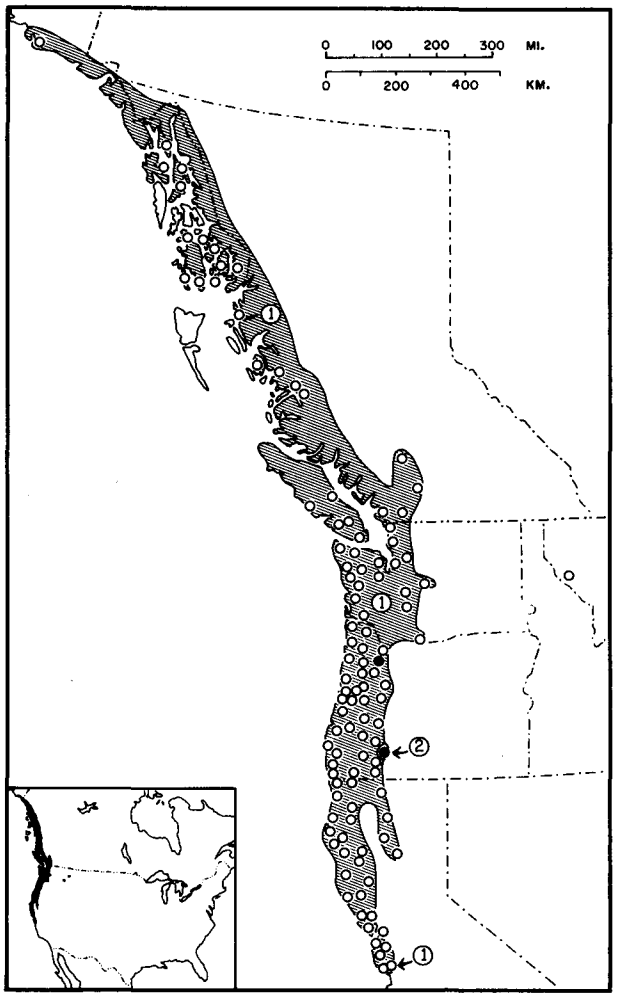
• DESCRIPTIONS. Riemer (1958) most fully described the external characteristics of metamorphosed individuals. Additional descriptions of external morphology were given by Skilton (1849), Twitty (1935, 1942), Fitch (1938), Gordon (1939), Bishop (1941, 1943), Myers (1942), Carl (1959), Pickwell (1947), Stebbins (1951, 1954, 1966), Pimentel (1952, 1958, 1959), Blair (1957), Freytag (1959), Livezey (1960), Livezey and Wyllie (1961), Fichter and Linder (1964), Black (1970), Cochran and Goin (1970), Nussbaum and Brodie (1971), Garber and Garber (1978) and Smith (1978). Descriptions of larvae were provided by Chandler (1918), Twitty (1935, 1942, 1966), Bishop (1943) and Stebbins (1951, 1954, 1966). Eggs were described by Twitty (1942), Stebbins (1951, 1954, 1966) and Salthe (1963). For a general account of the gross anatomy of *T. granulosa* (under the name *T. torosa*), see Smith (1927). Papers which provide descriptions of specific anatomical structures are Hilton (1947a, 1947b, 1947c, 1948, 1951), Larsen (1963), von Wahlert (1952), Weaver (1963), Baker (1965), Worthington and Wake (1972), Lombard (1977), Naylor (1978) and Wever (1978).

• ILLUSTRATIONS. Photographs and drawings of metamorphosed individuals are in Chandler (1918), Gordon (1939), Bishop (1941, 1943), Stebbins (1951, 1954, 1966), Cochran (1961), Stewart (1969), Black (1970), Coates et al. (1970), Leviton (1972), Hodge (1976), Garber and Garber (1978) and Smith (1978). Larvae were illustrated by Chandler (1918), Twitty (1935, 1942, 1966), Bishop (1943) and Stebbins (1966). Eggs were illustrated by Twitty (1942), Salthe (1963), Stebbins (1966) and Hodge (1976). Defensive postures were illustrated by Riemer (1958) and Johnson and Brodie (1975).

• DISTRIBUTION. *Taricha granulosa* occurs from southern Alaska southward through the humid, coastal forests of western British Columbia, western Washington, Oregon and northwestern California. The southernmost populations occur in Santa Cruz and Santa Clara Counties, California, immediately south of San Francisco Bay. The species has also been reported in the Rocky Mountains of northern Idaho and northwestern Montana. The most detailed documentation of distribution for *T. granulosa* appears in Riemer (1958). Nussbaum and Brodie (1971) suggested that *T. granulosa* was introduced to northern Idaho. Occurrence of *T. granulosa* in Montana is based on a single record over 20 years old, and the presence of this species in that state requires confirmation. Additional distributional data and/or range maps are in Storer (1925), Slevin (1928, 1934), Gordon (1939), Carl (1959), Bishop (1943), Pickwell (1947), Guppy (1953), Stebbins (1951, 1954, 1966), Brunson (1955), Logier and Toner (1961), Slater (1955, 1964), Ferguson (1956), Dunlap (1959), Fichter and Linder (1964), Storm (1966), Black (1970) and Hodge (1976).

• FOSSIL RECORD. None.

• PERTINENT LITERATURE. General accounts of the life history and ecology of *T. granulosa* are in Chandler (1918), Fitch (1936), Gordon (1939), Carl (1959), Bishop (1943), Watson (1944), Pickwell (1947), Farner (1947), Guppy (1947), Evenden (1948), Farner and Kezer (1953), Stebbins (1951, 1954, 1966), Packer (1961), Efford and Mathias (1969), Coates et al. (1970), Neish (1971a, 1971b) and Hodge (1976). Courtship was described by Guppy (1961), Davis and Twitty (1964) and Arnold (1972, 1977). Maslin (1950) commented on sound production; Wever (1978) discussed hearing. Twitty (1961a, 1961b, 1966) described hybridization with other species of *Taricha.* Seto and Pomerat (1965) described the karyotype. Olmo (1973) presented quantitative data on nuclear DNA. Genetic studies involving electrophoretic separation of proteins were published by Speaker (1965), Salthe and Kitto (1966), Coates (1967, 1968), Coates and Twitty (1967), Hedgecock and Ayala (1974), Ayala (1975) and Hedgecock (1977). Data on thermal physiology were provided by Hutchison (1961) and Brattstrom (1963). Studies on respiration were done by Czopek (1962, 1965), Whitford and Hutchison (1965, 1967), Smith (1967), Coates and Metcalfe (1971) and Wood (1971). Counts and measurements of red and white blood cells were reported by Hutchison and Szarski (1965), Szarski and Czopek (1966) and Friedmann (1970a, b, 1971, 1977). Thireau (1979) studied brain



MAP. Solid spots indicate type-localities; open circles mark other records. Symbols outside shaded areas represent disjunct populations.

size. Pimentel (1960), Carl (1961), Darrow (1967), Landreth and Ferguson (1967) and Briggs (1971, 1975) studied migration, orientation and circadian rhythms. Rieppel (1971) reported the effects of light on color intensity of adults. Both the ova (Mosher et al., 1964; Brodie et al., 1974) and the adult skin (Taylor, 1934; Stur, 1936; Brodie, 1968; Brodie et al., 1974; Wakely et al., 1966) are toxic. Adults are avoided by predators (Brodie, 1968) and assume a rigid antipredator posture (Stebbins, 1951; Riemer, 1958; Brodie, 1977). Bright ventral coloration and the defensive posture are aposematic to predators (Johnson and Brodie, 1975).

• ETYMOLOGY. The name *granulosa* is derived from *granulus* (L.), a small grain and *osus* (L.), meaning full of, in reference to the highly granular skin of the metamorphosed, terrestrial form. The name *mazamae* refers to the type locality, Mt. Mazama.

COMMENT

Until 1935, *Taricha torosa* was the only widely recognized species of western newt. Much of the literature prior to that date which purportedly describes aspects of the biology of *T. torosa*, may actually apply in part or totally to *T. granulosa* or *T. rivularis*. This is certainly true of Smith (1927). Some of the observations of Ritter (1897) on the life history of *T. torosa* may actually apply to *T. granulosa*. For instance, Ritter reported that some of the females observed by him deposited eggs singly, a characteristic of *T. granulosa*. As pointed out by Riemer (1958), both *T. granulosa* and *T. torosa* occur at the type-locality of *T. torosa*. Since Rathke's (in Eschscholtz, 1833) description of *T. torosa* is not complete enough to distinguish between *T. torosa* and *T. granulosa*, the name *torosa* may be based on a specimen of *granulosa*. It is likewise possible that *Triton ermani* Wiegmann and *Taricha laevis* Baird and Girard, generally listed as synonyms of *T. torosa*, are in truth synonyms of *T. granulosa*. If this could be proven, *Triton ermani* would have priority over *T. granulosa*. It is of interest that Girard (1858) reported that *laevis* may be distinguished from *torosa* by having "proportionally smaller eyes and more elongated toes." *T. granulosa* is known to have smaller eyes compared to *T. torosa*, a fact which suggests that *laevis* should be considered a junior synonym of *granulosa*.

1. *Taricha granulosa granulosa* (Skilton) Northern rough-skinned newt

Salamandra granulosa Skilton, 1849. See species synonymy.
Triturus similans Twitty, 1935. See species synonymy.
Triturus granulosus twittyi Bishop, 1941:16. Type-locality, "Saratoga, [Santa Clara County] California." Holotype, University of Michigan Museum of Zoology 89763, a male, collected 20 May 1936 by Victor C. Twitty, Margaret Wright, and Sherman C. Bishop (examined by authors).
T[riturus]. g[ranulosus]. granulosus: Bishop, 1941:18. First use of trinomial.
Triturus granulosus similans: Myers, 1942:79. First use of combination.
Taricha granulosa twittyi: Schmidt, 1953:26. First use of combination.
Taricha granulosa similans: Schmidt, 1953:27. First use of combination.
Taricha granulosa granulosa: Schmidt, 1953:26. First use of combination.

• DEFINITION. A subspecies of *T. granulosa* with a uniform yellow-orange venter.

COMMENT

Garber and Garber (1978) reported blotched or spotted *T. g. granulosa* in northern California. They suggested the subspecific status of these populations is uncertain. We have noted occasional spotted individuals in Oregon and Washington, and believe this color morph may occur in varying frequency throughout the range of *T. g. granulosa*.

2. *Taricha granulosa mazamae* (Myers) Crater Lake newt

Triturus granulosus mazamae Myers, 1942:80. Type-locality, "near Crater Lake on the higher slopes of Mt. Mazama, Crater Lake National Park, Klamath County, Oregon." Holotype, Stanford University 7465, now in the collections of California Academy of Sciences, San Francisco, CAS-SU 7465, an adult male, collected in the summer of 1938 by James P. Heath (not examined by authors).
Taricha granulosa mazamae: Schmidt, 1953:26. First use of combination.

• DEFINITION: A subspecies of *T. granulosa* with a suffusion of black pigment on the ventral surfaces, or, with encroachment of the dorsolateral dark pigment onto the ventral surfaces.

COMMENT

Individuals having the color patterns of *T. g. mazamae* occur in populations other than within the caldera of Mt. Mazama. The validity of this subspecies needs to be reconsidered.

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RONALD A. NUSSBAUM, THE UNIVERSITY OF MICHIGAN, ANN ARBOR, MICHIGAN 48109; EDMUND D. BRODIE, JR., ADELPHI UNIVERSITY, GARDEN CITY, LONG ISLAND, NEW YORK 11530.

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